fraction provided the basis for estimating the total population in the area as well as the minority and low-income components.

The analysis indicated that in one location the proportion of the minority population in the area associated with the manufacturing facility is higher than the proportion of the minority population in the state. The difference between the percentage of the minority population living inside the 16-kilometer (10-mile) radius and the state is 1.5 percent (DIRS 101941-USN 1996, p. 4-18). DOE anticipates very small impacts for the total population from manufacturing activities associated with all the scenarios, so there would be no disproportionately high and adverse impacts to the minority population near this facility.

In addition, the percentage of the total population that consists of low-income families living within about 16 kilometers (10 miles) of a manufacturing facility would exceed that of the associated state in one instance. The difference in this case was 0.9 percent (DIRS 101941-USN 1996, p. 4-18). DOE anticipates very small impacts to individuals and to the total population, and no special circumstances would cause disproportionately high and adverse impacts to the low-income population living near the facility.

The EIS analysis determined that only small human health and environmental impacts would occur from the manufacture of repository components. Disproportionately high and adverse impacts to minority or low-income populations similarly would be unlikely from these activities.

4.2 Short-Term Environmental Impacts from the Implementation of a Retrieval Contingency or Receipt Prior to the Start of Emplacement

4.2.1 IMPACTS FROM RETRIEVAL CONTINGENCY

Section 122 of the Nuclear Waste Policy Act requires DOE to maintain the ability to retrieve emplaced waste for an appropriate period after the start of emplacement. Nuclear Regulatory Commission regulations at 10 CFR 63.111(e) specify a retrieval period of at least 50 years. Because of this requirement, the EIS analyzed the impacts of retrieval. Although DOE does not anticipate retrieval and it is not part of the Proposed Action, DOE would maintain the ability to retrieve the waste for at least 100 years and possibly for as long as 324 years in the event of a decision to retrieve the waste either to protect the public health and safety or the environment or to recover resources from spent nuclear fuel. Some of the impacts that could occur during retrieval have been addressed in the Proposed Action under the lower-temperature operating mode with surface aging. This operating mode would include surface aging of up to two-thirds of the commercial spent nuclear fuel over a 50-year operations period (Chapter 2, Section 2.1.1.2.2). This aging facility could be used to store a portion of any spent nuclear fuel or high-level radioactive waste that would be retrieved.

This EIS evaluates retrieval as a contingency action and describes potential impacts if it were to occur. The analysis in this EIS assumes that under this contingency DOE would retrieve all the waste and would place it on a surface storage pad pending future decisions about its ultimate disposition. Storage of spent nuclear fuel and high-level radioactive waste on the surface would be in compliance with applicable regulations.

4.2.1.1 Retrieval Activities

If there was a decision to retrieve spent nuclear fuel and high-level radioactive waste from the repository, DOE would move the waste packages from the emplacement drifts to the surface. Operations in the subsurface facilities to remove the waste packages would be the reverse of emplacement operations and would use the same types of equipment (see Chapter 2, Section 2.1.2.2).

On the surface, the retrieved waste packages would be loaded on a vehicle for transport to a Waste Retrieval and Storage Area in Midway Valley, about 3.7 kilometers (2.3 miles) from the North Portal Operations Area, to which DOE would build a rail line or roadway. Figure 4-5 shows the relationship between these areas. The Waste Retrieval and Storage Area would include a Waste Retrieval Transfer Building, support facilities, and a number of concrete storage pads. To retrieve and store 70,000 MTHM of spent nuclear fuel and high-level radioactive waste, these facilities would cover about 1.5 square kilometers (380 acres) (DIRS 152010-CRWMS M&O 2000, Table I-2).

DOE based its selection of Midway Valley Wash as the site for retrieval activities on the following site selection criteria:

- Proximity to the repository North Portal Operations Area
- Retrieval of the waste in the shortest possible timeframe
- Adequate space for dry storage of 70,000 MTHM of waste
- No ground displacements due to earthquakes
- Siting outside the probable maximum flood zone
- Minimum costs for construction
- Minimum impacts to the environment

In the Waste Retrieval Transfer Building, the waste packages would be removed and placed in concrete storage modules (one container per module). The concrete module would protect the container and provide shielding. The module and container would then move to a concrete storage pad near the Waste Retrieval Transfer Building, where it would remain awaiting ultimate disposition. Figure 4-6 shows a concrete storage module design concept.

Studies of the strategies and options for retrieval (DIRS 100247-CRWMS M&O 1997, all) indicate that after a decision to retrieve the emplaced material, it would take about 10 years to plan the operation, procure the necessary equipment, and prepare the Waste Retrieval and Storage Area; subsequently, about 3 years would be needed for the initial construction of facilities and storage areas. After initial construction, the retrieval operations would require another 11 years, concurrent with an additional 7 years of storage area construction. DOE performed an impact analysis for the retrieval contingency only for the higher-temperature repository operating mode. Since 70,000 MTHM of spent nuclear fuel and high-level radioactive waste would be emplaced under the Proposed Action for all operating modes, the analysis of impacts for this operating mode is sufficient to describe the types and magnitudes of impacts that would occur if DOE implemented the retrieval contingency. Retrieval could be accomplished more quickly than the initial emplacement because limitations in material shipping and delivery as well as emplacement preparation (for example, waste package welding) would not be encountered.

4.2.1.2 Impacts of Retrieval

The following sections present the results of the environmental impact analysis for the retrieval contingency. They consider the construction of the Waste Retrieval and Storage Area, retrieval of the waste packages and their movement to the surface and to the Waste Retrieval and Storage Area, and the loading of the waste packages in concrete storage modules and their placement on concrete storage pads.

4.2.1.2.1 *Impacts to Land Use and Ownership from Retrieval*

Retrieval would cause no land use and ownership impacts during the construction of the Waste Retrieval and Storage area because the retrieval area would be on lands already withdrawn and under DOE control. DOE would develop the Waste Retrieval and Storage area on a 1.5-square-kilometer (380-acre) area approximately 3.7 kilometers (2.3 miles) north of the North Portal Operations Area in Midway Valley (see Figure 4-5). If DOE used surface aging under the lower-temperature repository operating mode, the

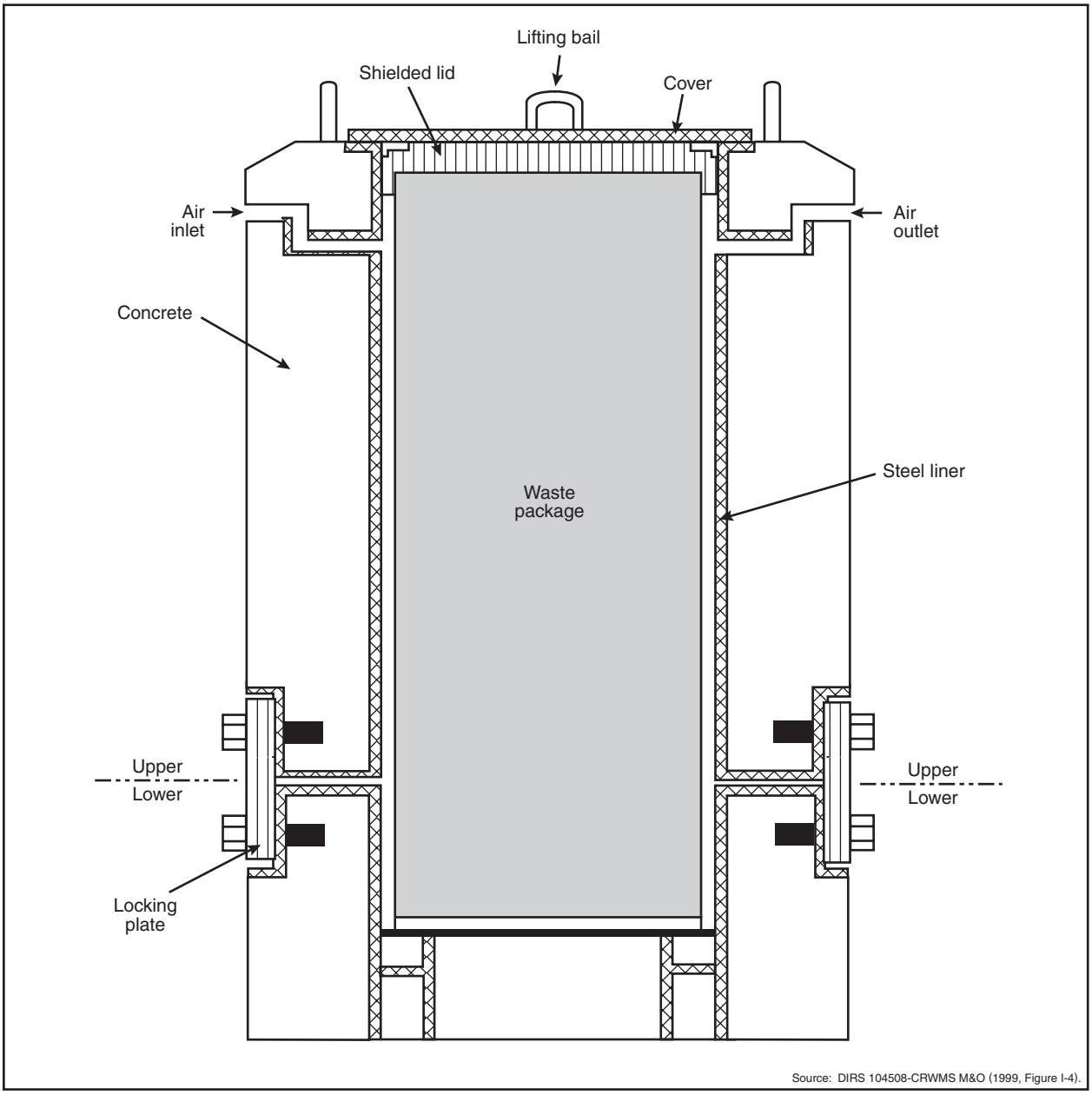

Figure 4-6. Typical concrete storage module design, vertical view.

aging pads could be available for use during retrieval operations, reducing the additional area disturbed for retrieval.

4.2.1.2.2 *Impacts to Air Quality from Retrieval*

The construction of the Waste Retrieval and Storage Area and the movement of the spent nuclear fuel and high-level radioactive waste to the surface would result in air quality impacts. The analysis considered both radiological and nonradiological impacts. No radiological air quality impacts would occur during the placement of the storage containers in concrete storage modules, assuming the containers remained intact and free from leaks during handling. However, radon-222 would be released from the active ventilation of the subsurface.

Nonradiological Air Quality Impacts. DOE evaluated nonradiological air quality impacts from the retrieval of materials from the repository for (1) the construction of a Waste Retrieval and Storage Area and (2) the retrieval process. Construction and retrieval activities would result in releases of nitrogen dioxide, sulfur dioxide, carbon monoxide, and PM_{10}. Retrieval activities would not involve subsurface excavation or result in disturbance of the excavated rock pile, so no releases of cristobalite would occur.

Construction equipment would release nitrogen dioxide, sulfur dioxide, carbon monoxide, and PM_{10} from fuel consumption. Fugitive dust, assumed to be all PM_{10}, would also be released during construction from earthmoving activities and operation of a concrete batch plant in the North Portal Operations Area. The analysis did not take credit for the standard construction dust suppression measures that DOE would implement to lower the projected PM_{10} concentrations. Table 4-53 lists calculated concentrations for criteria pollutant impacts at the location of the public maximally exposed individual and compares these concentrations to regulatory limits. The nitrogen dioxide, sulfur dioxide, carbon monoxide, and PM_{10} concentrations at the location of the maximally exposed individual would be less than 2 percent of the applicable regulatory limits in all cases.

Table 4-53. Criteria pollutant impacts to public maximally exposed individual from retrieval (micro-grams per cubic meter).[a,b]

Pollutant	Averaging time	Regulatory limit[c]	Maximum concentration[d]	Percent of regulatory limit
Nitrogen dioxide	Annual	100	0.023	0.023
Sulfur dioxide	Annual	80	0.0022	0.0028
	24-hour	365	0.018	0.0049
	3-hour	1,300	0.14	0.011
Carbon monoxide	8-hour	10,000	0.20	0.0020
	1-hour	40,000	1.3	0.0033
Particulates (PM_{10}) ($PM_{2.5}$)	Annual	50 (15)	0.23	0.45
	24-hour	150 (65)	2.8	1.9

a. Appendix G, Section G.1, contains detailed information on the radiological air quality analysis.
b. All numbers except regulatory limits are rounded to two significant figures.
c. Regulatory limits from 40 CFR 50.4 through 50.11, and Nevada Administrative Code 445B.391 (see Chapter 3, Table 3-5).
d. Sum of the highest concentrations at the accessible site boundary regardless of direction.

Radiological Air Quality Impacts. During retrieval activities subsurface ventilation would continue, resulting in releases of naturally occurring radon-222 and its decay products in the ventilation exhaust. Subsurface ventilation would continue for the duration of retrieval, lasting about 14 years with 3 years of initial construction (10 total years of construction), followed by 11 years of retrieval operations. Table 4-54 lists estimated annual and total doses from 14 years of retrieval activities to maximally exposed individuals and potentially affected populations from radon-222 released from subsurface facilities.

4.2.1.2.3 *Impacts to Hydrological Resources from Retrieval*

4.2.1.2.3.1 Surface Water. The retrieval activity that could have surface-water impacts would be the construction of the Waste Retrieval and Storage Area, which would disturb an area of 1.5 square kilometers (380 acres) (DIRS 152010-CRWMS M&O 2000, Table I-2).

Potential for Runoff Rate Changes. The total disturbed area would include areas cleared to support construction equipment and materials, facilities, and concrete storage pads. If DOE retrieved all the waste, the storage pad area would account for about 0.48 square kilometer (120 acres) of the disturbed land (DIRS 152010-CRWMS M&O 2000, Table I-1, p. I-12). Including the areas covered by facilities, roadways, and queuing areas, about half of the land disturbance would result in surface areas that would provide almost no infiltration, so precipitation would result in runoff from the Waste Retrieval and

Table 4-54. Estimated radiation doses to maximally exposed individuals and populations from subsurface radon-222 releases during the retrieval period.[a,b]

Impact	Total	Annual
Dose to public		
Maximally exposed individual[c] (millirem)	2.7	0.19
80-kilometer[d] population[e] (person-rem)	50	3.6
Dose to noninvolved (surface) workers		
Maximally exposed noninvolved (surface) worker[f] (millirem)	0.019	0.0040
Yucca Mountain noninvolved worker population (person-rem)	0.0045	0.00039
Nevada Test Site noninvolved worker population[g] (person-rem)	0.0031	0.00033

a. Appendix G, Section G.2, contains detailed information about the radiological air quality analysis.
b. Construction and retrieval activities would last 14 years.
c. At the southern boundary of the land withdrawal area.
d. 80 kilometers = 50 miles.
e. Approximately 76,000 individuals within 80 kilometers of the repository (see Chapter 3, Section 3.1.8).
f. Maximally exposed noninvolved worker would be at the South Portal Development Area.
g. DOE workers at the Nevada Test Site [6,600 workers (DIRS 101811-DOE 1996, p. 5-14) 50 kilometers (30 miles) east-southeast near Mercury, Nevada].

Storage Area. As described in Section 4.1.3.2, if precipitation did not generate runoff from surrounding areas, the runoff from the storage area could travel to otherwise empty drainage channels, but would not go far. If precipitation generated runoff everywhere, there would be little difference in the quantity produced in the storage area; it just would occur earlier in the storm. In addition, a comparison of the 1.5 square kilometers (380 acres) of disturbed land to the estimated 12 square kilometers (3,000 acres) that make up the Midway Valley Wash drainage area (DIRS 108883-Bullard 1992, Table 5) indicates that changes in runoff and infiltration rates should have little impact on how the entire drainage area responded to precipitation events.

Potential for Altering Natural Drainage. The proposed location for the Waste Retrieval and Storage Area does not cross or intercept well-defined drainage channels with the exception of the northwest corner, which could be close to, or possibly overlay, a short stretch of the upper Midway Valley Wash. Other portions of the facility would be in an area where simple overland flow probably would dominate runoff events. Design layouts of the proposed facility call for the construction of an interceptor trench along the upstream (north) side of the area, extending down either side; this would prevent runoff from entering the storage facility and could be an alteration to existing drainage. If flow in this short stretch of the upper Midway Valley Wash was intercepted, it would be diverted around the facility and then back to the existing course. Siting criteria for this proposed facility state that it will be located in a manner to minimize the engineering needed to protect it against the probable maximum flood zone (DIRS 152010-CRWMS M&O 2000, p. I-5). Therefore, a probable maximum flood in this small wash would not affect the retrieved material.

Potential for Flooding. The Waste Retrieval and Storage Area would be outside the probable maximum flood zone, although natural drainage might be altered to ensure this is the case. The interceptor trench on the north side of the facility would accommodate the highest quantities of runoff that could reasonably be present. Therefore, there would be no reasonable potential for flooding to affect the storage facility.

4.2.1.2.3.2 Groundwater. The retrieval activities that could have impacts on groundwater would be the construction of the Waste Retrieval and Storage Area and the retrieval of the emplaced material.

Potential for Infiltration Rate Changes. About half of the disturbed land would be covered by facilities, roadways, queuing areas, and storage pads. These facilities would be relatively impermeable to water, and would cause an additional amount of runoff to drainage channels in comparison to natural conditions. This additional runoff could cause a net increase in the amount of water to infiltrate these

natural channels. The additional infiltration would move into the unsaturated zone and represent potential recharge to the aquifer, but it would be a minor amount in comparison to natural infiltration.

Impacts to Groundwater Resources. The estimated annual groundwater demand during retrieval would peak at about 170,000 cubic meters (140 acre-feet) a year (DIRS 152010-CRWMS M&O 2000, pp. I-18 and I-20; DIRS 150941-CRWMS M&O 2000, p. 6-20). No adverse impacts would be likely from this demand, which would be well within historic use rates.

4.2.1.2.4 *Impacts to Biological Resources and Soils*

The retrieval activity that could affect biological resources and soils would be the construction of the Waste Retrieval and Storage Area.

4.2.1.2.4.1 Impacts to Biological Resources from Retrieval. Impacts to biological resources would be similar to those described for construction and operations (see Section 4.1.4).

Impacts to Vegetation. The construction of retrieval facilities would disturb vegetation in an area that is presently undisturbed. The predominant land cover types in Midway Valley are blackbrush and Mojave mixed scrub, both of which are extensively distributed regionally and in the State of Nevada.

Impacts to Wildlife. Impacts to wildlife from the retrieval contingency would be similar to those described for the construction and operation of the repository. They would consist of limited habitat loss and the deaths of individuals of some species as a result of construction activities and vehicle traffic, and would be in addition to those associated with repository construction and operation.

Impacts to Special Status Species. Impacts to special status species from the retrieval contingency would be similar, and in addition to, those described for repository construction. They would consist of loss of a small portion of locally available habitat for the desert tortoise and the deaths of individual tortoises due to construction activities and vehicle traffic.

Impacts to Wetlands. No wetlands would be affected by activities associated with retrieval.

4.2.1.2.4.2 Impacts to Soils from Retrieval. Concrete pads, facilities, and roadways at the Waste Retrieval and Storage Area would eventually cover about half of the 1.5 square kilometers (380 acres) of disturbed land, but a sizable portion would remain as disturbed soil.

Soil Loss. Erosion concerns during the construction of the retrieval facilities would be the same as those described for the construction of the repository facilities (see Section 4.1.4.4). The types of soils encountered would be similar to, if not the same as, those encountered during the construction at the North Portal Operations Area and South Portal Development Area. As during other project activities, DOE would use dust suppression measures to reduce the disturbed land's erodibility.

After the construction of the retrieval facilities, much of the area would no longer be exposed to erosion forces because structures would cover the soil. However, the uncovered disturbed areas would be more susceptible to erosion than the surrounding natural areas. This would be the case until the disturbed land had time to reach equilibrium, including the reestablishment of vegetation. Erosion, if it occurred, probably would involve small amounts of soil from small areas. The amount of soil that could move downwind or downgradient should not present unusual concerns.

Recovery. DOE would reclaim disturbed lands when they were no longer needed for retrieval operations.

4.2.1.2.5 *Impacts to Cultural Resources from Retrieval*

The activity that could affect cultural resources would be the construction of the Waste Retrieval and Storage Area. The following sections discuss archaeological and historic resources and Native American interests in relation to retrieval.

Archaeological and Historic Resources. The results of earlier archaeological fieldwork indicate that there are no National Register-eligible archaeological resources on land recommended for the Waste Retrieval and Storage Area or near the proposed rail or road construction. Therefore, construction activities associated with retrieval probably would not result in direct impacts to National Register-eligible archaeological resources. As during repository construction and operation, increased activities and numbers of workers could increase the potential for indirect impacts to archaeological sites near the construction work.

Native American Interests. A Waste Retrieval and Storage Area in Midway Valley would be 500 meters (1,600 feet) west of the Yucca Wash local use area and Alice Hill. As described in DIRS 102043-AIWS (1998, all), these areas have cultural importance to Native Americans. There could be some direct or indirect impacts to these areas, depending on the specific locations of Native American significance boundaries.

4.2.1.2.6 *Impacts to Socioeconomics from Retrieval*

Waste retrieval activities would increase the repository workforce above that for ongoing monitoring and maintenance activities. A maximum annual employment of about 600 workers (DIRS 152010-CRWMS M&O 2000, pp. I-18 and I-20; DIRS 150941-CRWMS M&O 2000, p. 6-20) would be required during retrieval operations and concurrent storage pad construction. Retrieval would last about 14 years. Employment during retrieval would be less than during other project phases and would be unlikely to generate meaningful changes to the region of influence's employment or economic measures. Regional impacts from retrieval would be small.

4.2.1.2.7 *Occupational and Public Health and Safety Impacts from Retrieval*

The analysis of health and safety impacts to workers considered industrial safety hazards and radiological impacts from construction and retrieval operations, as discussed earlier in this section. During construction activities DOE would build (1) the surface facilities necessary to handle retrieved waste packages and enclose them in concrete storage units in preparation for their placement on concrete storage pads, and (2) the concrete storage pads (see Section 4.2.1.1). No radioactive materials would be involved in the construction activities, so health and safety impacts would be limited to those associated with industrial hazards in the workplace. DOE expects initial construction to last about 3 years, with construction of the concrete storage pads continuing concurrently with retrieval operations for an additional 7 years.

During retrieval operations DOE would retrieve the waste packages and move them to the Waste Retrieval Transfer Building. Surface facility workers would unload the waste package from the transfer vehicle and place it on a concrete base. The waste package would be enclosed in a concrete storage unit that, with the waste package inside, would be placed on the concrete storage pad. Retrieval operations would last about 11 years. The analysis estimated the health and safety impacts from both industrial hazards and from radiological hazards from operations for both surface and subsurface workers.

Radiological impacts to the public could occur during all 14 years of the retrieval period when radon-222 and its decay products would be released to the environment in the exhaust stream from the subsurface

ventilation system. There would be no other source of radiation exposure to the public, and no differentiation between the construction and operations activities.

The methods used to estimate health and safety impacts to workers and the public were the same as those used to estimate such impacts for the Proposed Action (see Appendix F, Section F.2.1). Additional information pertinent to health and safety impact analysis for retrieval is contained in Appendix F, Section F.4.

Industrial Health and Safety Impacts

Industrial health and safety impacts occur only to workers. As noted above, the only health and safety impacts during retrieval construction activities would be those from industrial hazards during normal workplace activities. These impacts are shown in Table 4-55. Projected fatality would be about 0.05 and projected lost workday cases would be about 46.

Table 4-55. Health and safety impacts from industrial hazards from retrieval construction, operations, and overall impacts.[a,b]

Worker group and impact category	Construction[c]	Retrieval operations[d]	Overall impact[e]
Involved workers			
Total recordable cases	80	35	120
Lost workday cases	38	15	53
Fatalities	0.04	0.03	0.07
Noninvolved workers			
Total recordable cases	16	35	51
Lost workday cases	8	17	25
Fatalities	0.01	0.04	0.04
All workers (totals)[e]			
Total recordable cases	96	70	170
Lost workday cases	46	32	78
Fatalities	0.05	0.07	0.12

a. Numbers rounded to two significant figures.
b. Sources: Calculated using impact rates from Appendix F, Table F-71 and full-time equivalent work years from Table F-70.
c. Source: Appendix F, Table F-73.
d. Source: Appendix F, Tables F-74 and F-75.
e. Totals might differ from sums of values due to rounding.

Industrial health and safety impacts from retrieval operations are also shown in Table 4-55, as are the overall impacts. Total impacts would be small, with an estimated total of 0.12 fatality and 78 lost workday cases.

Radiological Health Impacts

Radiological health impacts may occur to both workers and members of the public. Table 4-56 lists radiological health impacts for both surface and subsurface workers for the retrieval contingency as well as the total radiological impact to all workers. Most of the radiation dose would be to subsurface workers during retrieval operations, and Appendix F contains additional details on estimates of radiation dose to subsurface workers. Impacts would be small, with the latent cancer fatality likelihood for the maximally exposed individual being about 0.002. The calculated latent cancer fatality incidence to workers for retrieval would be 0.06.

The only source of radiation exposure to members of the public during construction and retrieval operations would be from releases of radon-222 and its decay products through the subsurface ventilation system exhaust. Table 4-54 presents the estimated radiation doses to members of the public from these releases.

Table 4-56. Radiological health impacts to workers from retrieval operations.[a,b,c]

Worker group and impact category	Surface facility workers	Subsurface facility workers	High/total[d]
Maximally Exposed Worker dose (rem)			*High*
Involved	0.28	5.9	5.9
Noninvolved	0	0.44	0.44
Probability of latent cancer fatality			
Involved	0.00011	0.002	0.002
Noninvolved	0	0.0002	0.0002
Worker population			*Total*
Collective dose (person-rem)			
Involved	8	120	130
Noninvolved	0	4	4
Total[e]	**8**	**130**	**140**
Number of latent cancer fatalities			
Involved	0.003	0.05	0.05
Noninvolved	0	0.002	0.002
Total[e]	**0.003**	**0.05**	**0.06**

a. Sources: Appendix F, Tables F-76 and F-77.
b. All impacts from operations. Radiological health impacts to workers during construction would be minimal.
c. Numbers are rounded to two significant figures.
d. Highest individual and population totals for the 11-year retrieval period.
e. Totals might differ from sums of values due to rounding.

Table 4-57 lists estimated radiological health impacts to the public for retrieval. The estimated radiological health impacts to members of the public from the retrieval contingency would be small. The likelihood of a latent cancer fatality for the maximally exposed individual would be about 0.0000013. The estimated latent cancer fatality incidence in the exposed population would be about 0.025.

Table 4-57. Radiological health impacts to the public for the retrieval period.

Worker group and impact category	Impact
Individual	
Maximally exposed individual dose (millirem)[a]	2.7
Latent cancer fatality probability	0.0000013
Population	
Collective dose (person-rem)[a]	50
Latent cancer fatality incidence	0.025

a. Source: Table 4-54.

4.2.1.2.8 *Impacts from Accidents During Retrieval*

During retrieval operations, activities at the repository would be essentially the reverse of waste package emplacement, except operations in the Waste Handling Building would not be necessary because the waste packages would not be opened. The handling accident scenario applicable for these operations would be bounded by the transporter runaway accident scenario evaluated in Section 4.1.8. The waste packages would be retrieved remotely from the emplacement drifts, transported to the surface, and transferred to a Waste Retrieval and Storage Area (DIRS 102702-CRWMS M&O 1997, all). This area would include a Waste Retrieval Transfer Building where the waste packages would be unloaded from the transporter, transferred to a vertical concrete storage unit, and moved to a concrete storage pad.

Because the retrieval operations would be essentially the same as the emplacement operations (in reverse), the accident scenarios involving the waste package during operations would bound the retrieval operation. The bounding accident scenario during emplacement would be a transporter runaway and derailment accident in a main drift (see Appendix H, Section H.2.1.4). For above-ground storage accidents, the accident analysis for the continued storage analysis would apply. Recent analyses have found that the only credible accident with the potential for radiological consequences would be an aircraft

crash into one of the above-ground storage facilities. However, the aircraft would not penetrate the thickness of the waste package (DIRS 157108-Jason 2001, all).

The analysis assumed that above-ground storage following retrieval would be licensed in compliance with Nuclear Regulatory Commission requirements (10 CFR Part 72). These requirements specify that storage modules must be able to withstand credible accident-initiating events.

4.2.1.2.9 *Noise Impacts from Retrieval*

The analysis in Section 4.1.9 shows that there would be no appreciable noise impacts for the construction, operation and monitoring, and closure phases of repository operations. Noise impacts associated with retrieval would be less than those associated with repository operations because of the reduced scope of activities and the smaller number of workers required. Thus, noise impacts from retrieval operations would be small.

4.2.1.2.10 *Aesthetic Impacts from Retrieval*

Retrieval activities would not be likely to produce adverse impacts on the visual quality of the landscape surrounding Yucca Mountain. Retrieval would essentially be the reverse of emplacement and would use the same types of equipment. Impacts from emplacement would be small. The only difference from the emplacement activities would be the construction of a Waste Retrieval and Storage Area in Midway Valley north of the North Portal Operations Area with a connecting transportation corridor. These activities would occur in the repository area and in Class C scenic quality lands away from the public view and, therefore, would have no impact on the existing visual character of the landscape.

4.2.1.2.11 *Impacts to Utilities, Energy, Materials, and Site Services from Retrieval*

The following sections discuss utility, energy, materials, and site service impacts.

Utilities and Energy. The estimated electric power demand for retrieval would be less than 10 megawatts. This demand would be well within the capacity that would be available at the repository.

The fossil-fuel use estimated for retrieval activities would approach 25 million liters (6.6 million gallons). This consumption level is less than 0.1 percent of the annual consumption in the State of Nevada. In addition, the repository would use about 2 million liters (530,000 gallons) of hydraulic oil and lubricants, which DOE would recycle.

Materials. For the Waste Retrieval and Storage Area, DOE would build a concrete pad and retrieval support facilities. Construction would require about 600,000 cubic meters (780,000 cubic yards) of concrete and 46,000 metric tons (51,000 tons) of steel, which would not affect the regional supply capacity. About 11,000 concrete storage modules would be required. The concrete would be obtained from offsite sources or the onsite batch plant would be used. The storage modules would be relatively simple concrete vessels with a 0.64-centimeter (0.25-inch) steel liner. About 121,000 cubic meters (158,000 cubic yards) of concrete would be required to build 11,000 modules, which probably would be manufactured commercially. Material usage impacts would be small. The impacts of shipping about 11,000 concrete storage modules to the site would be comparable to those for shipping about 11,000 disposal containers to the site (see Chapter 6, Section 6.1.3).

Site Services. The onsite emergency response capability and the security, medical, and fire protection units that would support operations would be available to support retrieval, so no additional impacts would be likely.

Table 4-58 summarizes impacts to utilities, energy, and materials.

Table 4-58. Utilities, energy, and materials for retrieval.[a,b,c]

	Electric		Fossil fuel		Construction materials	
Location	Peak (MW)[d,e]	Use (1,000 MWh)[f]	Liquid fuels (million liters)[g]	Oils (million liters)	Concrete (1,000 cubic meters)[h]	Steel (1,000 metric tons)[i]
Surface	1.3	83	21	0.034	600	46
Subsurface	7.7	700	0.3	2.2	0	0
Totals	***9.0***	***780***	***21.3***	***2.2***	***600***	***46***

a. Sources: DIRS 104508-CRWMS M&O (1999, pp. I-22 to I-24); DIRS 104523-CRWMS M&O (1999, p. 6-35).
b. All entries except peak electric power are cumulative totals for the entire period.
c. Approximate retrieval period would be 14 years.
d. Peak electric power is the peak demand that would occur during the period.
e. MW = megawatts.
f. MWh = megawatt-hours.
g. To convert liters to gallons, multiply by 0.26418.
h. To convert cubic meters to cubic yards, multiply by 1.3079.
i. To convert metric tons to tons, multiply by 1.1023.

4.2.1.2.12 *Impacts to Waste Management from Retrieval*

The construction of the Waste Retrieval and Storage Area would generate an estimated maximum of 13,000 cubic meters (460,000 cubic feet) of construction debris, 2,800 cubic meters (99,000 cubic feet) of sanitary and industrial solid waste, and 520 cubic meters (18,000 cubic feet) of hazardous waste (DIRS 104508-CRWMS M&O 1999, p. I-22). Based on operations generation rates, retrieval of the waste packages would generate an estimated 4,900 cubic meters (170,000 cubic feet) of sanitary and industrial solid waste. Throughout the construction of the retrieval facilities and retrieval operations, the workforce would generate sanitary sewage. After the spent nuclear fuel and high-level radioactive waste were placed in the concrete storage modules and on the concrete storage pads, waste generation would continue due to the presence of a workforce. Surveillance and monitoring activities would generate sanitary and industrial solid and low-level radioactive waste.

Construction debris and sanitary and industrial solid waste would be disposed of at onsite facilities or at the Nevada Test Site. Sanitary sewage would be disposed of at onsite facilities. Low-level radioactive waste would be disposed of at the Nevada Test Site or another government or commercial facility in accordance with applicable Federal and state requirements. Hazardous waste would be shipped off the site for treatment and disposal at a permitted commercial facility. As discussed in Section 4.1.12, the available capacity for hazardous waste treatment and disposal in the western states would exceed the demand. Assuming this trend would continue, hazardous waste possibly generated during retrieval activities would have a very small impact on the capacity for treatment and disposal at commercial facilities.

4.2.1.2.13 *Impacts to Environmental Justice from Retrieval*

Workers at the Yucca Mountain site would be representative of the population mix in the surrounding areas of Nevada. Hence, there would be no disproportionate impacts to minority or low-income workers in the Yucca Mountain region during retrieval activities. Disproportionate impacts to minority or low-income populations from retrieval construction and operation activities would be unlikely. Impacts to areas of cultural importance to American Indians could vary depending on the conduct of activities and the location of significance boundaries.

4.2.2 IMPACTS FROM RECEIPT PRIOR TO THE START OF EMPLACEMENT

Repository operations would begin after DOE received a license from the Nuclear Regulatory Commission to receive and possess spent nuclear fuel and high-level radioactive waste. For this EIS,

DOE assumed that the receipt and emplacement of spent nuclear fuel and high-level radioactive waste would begin in 2010 and occur over a 24-year period (70,000 MTHM at approximately 3,000 MTHM per year), unless surface aging was used, in which case there would be a 50-year operations period. The EIS considers the potential for the transport of spent nuclear fuel or high-level radioactive waste to the Yucca Mountain site several years before the waste was actually emplaced in the repository as a contingency action, not part of the Proposed Action. DOE recognizes that regulatory changes would have to occur for the receipt of spent nuclear fuel and high-level radioactive waste before the start of emplacement, and would have to build a facility similar to that described as part of the retrieval contingency (Section 4.2.1.1) for the receipt of these materials pending their emplacement.

Such a facility would consist of a series of concrete pads in the Midway Valley Wash area (the same area described for the retrieval contingency). The facility would be capable of storing as much as 40,000 MTHM of spent nuclear fuel and high-level radioactive waste in concrete storage modules.

The types of impacts resulting from the construction and operation of a Waste Staging Facility would be similar to those from the implementation of a retrieval contingency, described in Section 4.2.1. The impacts would include land disturbance, emission of particulate and gaseous pollutants, and radiation doses from the handling of spent nuclear fuel and high-level radioactive waste. In all cases, potential impacts would be bounded by those presented for the lower-temperature operating mode in Section 4.1.

REFERENCES

Note: In an effort to ensure consistency among Yucca Mountain Project documents, DOE has altered the format of the references and some of the citations in the text in this Final EIS from those in the Draft EIS. The following list contains notes where applicable for references cited differently in the Draft EIS.

102043	AIWS 1998	AIWS (American Indian Writers Subgroup) 1998. *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement.* Las Vegas, Nevada: Consolidated Group of Tribes and Organizations. ACC: MOL.19980420.0041.
104926	Bauhaus 1998	Bauhaus, M. 1998. Estimate of 1998 Concrete to be Used in the Las Vegas Area. Telephone conversation from M. Bauhaus to M. Sherwood (Nevada Ready Mix), August 7, 1998, EIS: AR-GEN-35654. ACC: MOL.19990511.0382.
103074	BEA 1992	BEA (Bureau of Economic Analysis) 1992. *Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II).* BEA REA 92-01. 2nd Edition. Washington, D.C.: U.S. Department of Commerce. TIC: 242623.
103075	Bechtel 1997	Bechtel Nevada 1997. *Ecological Monitoring and Compliance Program Fiscal Year 1997 Report.* Las Vegas, Nevada: Bechtel Nevada, Ecological Services. TIC: 243786.
102475	Brussard et al. 1994	Brussard, P.F.; Berry, K.H.; Gilpin, M.E.; Jacobson, E.R.; Morafka, D.J.; Schwalbe, C.R.; Tracy, C.R.; and Vasek, F.C. 1994. *Desert Tortoise (Mojave Population) Recovery Plan.* Portland, Oregon: U.S. Fish and Wildlife Service. TIC: 241399.